

# Precision Measurement of the Parity-Violating Gamma Asymmetry in the Capture of Polarized Cold Neutrons by Para-Hydrogen

*T. Case, S.J. Freedman, B. Lauss  
and the NPDGamma Collaboration\**

The weak part of the hadronic interaction manifests itself in parity-violating phenomena which can be observed in nuclei.

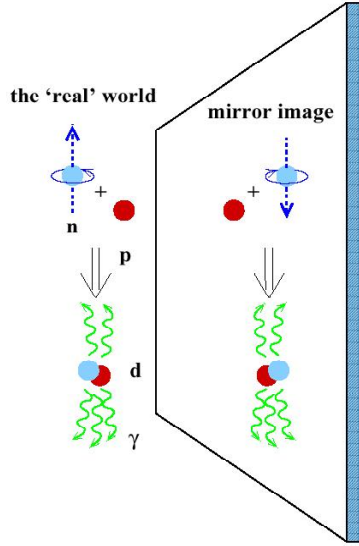


Figure 1: The capture process of spin-polarized neutrons on para-hydrogen shows a directional asymmetry in the distribution of emitted  $\gamma$ 's.

The weak contribution to the nucleon-nucleon force can be represented by meson exchange potentials, attributed to for example  $\pi$ ,  $\rho$ ,  $\omega$  together with a specific meson-nucleon-nucleon coupling constant; the long-range force is mainly caused by the lightest meson, the pion.

The  $npd\gamma$  experiment intends to measure with a relative precision of  $10^{-8}$  the parity violating  $\gamma$ -asymmetry ( $A_\gamma$ ) with respect to the neutron spin in the capture of cold polarized neutrons on para-hydrogen:  $\bar{n} + p \rightarrow d + \gamma$  (Fig.1).  $A_\gamma$  is directly related to the weak coupling constant  $H_\pi^1$ .

The experiment is conducted at flight path 12 (Fig.2) at the Los Alamos Neutron Science Center (LANSCE) which was especially constructed for fundamental neutron science.

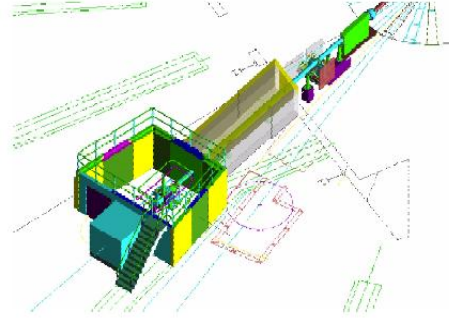


Figure 2: Schematic view of the neutron flight path 12 and the experimental cave at LANSCE.

The  $npd\gamma$  experimental-apparatus - consisting of a high pressure polarized  $^3\text{He}$  neutron spin filter, a RF neutron spin flipper, a liquid para-hydrogen target, and a CsI detector array to detect the 2.2 MeV  $\gamma$  following neutron capture - is situated within a magnetic guide field of high stability. The magnetic field coils have been constructed at Berkeley; Fig.3 shows part of the finished stand with 3 of the 4 coils visible.

The experiment is presently being assembled and data taking is scheduled to start in late 2003.



Figure 3: Finished coils with flux-gate scanner.

\*Hamilton College, JINR Dubna, Indiana University, KEK, LANL, NIST, TJNAF, UC Berkeley and LBNL, University of Manitoba and TRIUMF, University of Michigan, University of New Hampshire.